THE X-RAYS.

To the Editor of Science: As opportunity offered experiments have been made in our laboratory with the X-rays since a few days after the appearance of Prof. Röntgen's paper. Of course, we have repeated most of the experiments that have been announced from trustworthy sources; but I recall one or two observations made here that I have not seen notice of, and take the liberty of offering the account to your journal. I use a Ruhmkorff coil with Foucault interrupter. About two ampères from accumulators, through the primary gives about six-inch spark in the secondary. For a tube I have used one of my old Crookes tubes. The one I have found to work best is pear-shaped, nine inches long, four inches in diameter at the larger end, with a flat disc cathode in the small end, set with the plane of the disc perpendicular to the length of the tube, and for anode it has a Maltese cross inserted about the middle. The cross is hinged so that it may be shaken down and thus not obstruct the cathode radiation. The tube is the one designed, in Crookes set, to show that the cathode radiation is in straight lines and will 'cast a shadow.' The first plate I exposed was with this tube, the cross of the anode being up so as to cast a shadow in the end of the tube. The plate being close to the tube, a clear shadow of the anode was cast upon it. On repeating the experiment with the sensitive plate six inches distant, there was no image of the cross on the plate, which was, instead, densely 'light struck' all over. This adds another to the quite numerous proofs that the X-rays originate at the phosphorescent surface of the glass and not at the cathode. The second observation I wish to notice is a perfectly simple and commonplace method of getting a sharp clear image by these X-rays, which refuse to be reflected or refracted. It is the use of a metal diaphragm interposed between the tube and the sensitive plate. I have found a metal plate with a circular hole one inch in diameter, placed half an inch from the tube, the tube being six inches from the sensitive plate to give very satisfactory results.*

The most interesting observation is a physiological effect of the X-rays. A month ago we were asked to undertake the location of a bullet in the head of a child that had been accidentally shot. On the 29th of February Dr. Wm. L. Dudley and I decided to make a preliminary test of photographing through the head with our rather weak apparatus before undertaking the surgical case. Accordingly Dr. Dudley, with his characteristic devotion to the cause of science, lent himself to the experiment. A plateholder containing the sensitive plate was tied to one side of his head, with a coin between the plate and his head, and the tube was set playing on the opposite side of his head. The tube was about one-half inch distant from his hair, and the exposure was one hour. The plate developed nothing; but yesterday, 21 days after the experiment, all the hair came out over the space under the X-ray discharge. The spot is now perfectly bald, being two inches in diameter. This is the size of the X-ray field close to this tube. We, and especially Dr. Dudley, shall watch with interest the ultimate effect. The skin looks perfectly healthy, and there has been no pain nor other indication of disorder. I called attention to the place before Dr. Dudley had himself noticed it, and we were both for some time at a loss to account for it, as we had no previous intimation of any effect whatever.

But this little incident may bear a suggestion. The X-rays are as yet unexplained; but the suggestion, beginning with Prof. Röntgen himself, has more than once been made that they are longitudinal rather than transverse vibrations. It is difficult to distinguish a longitudinal displacement of the ether from an electric current, as far as it goes. It is a well-known method of exterminating hair, that of sending a current to its roots by a needle. If any such quasi electric current has resulted from the X-rays the effect upon the hair might be thus accounted for. The intensity of the discharge was not sufficient to heat the tube except very

*I enclose two prints, one of a hand and one of a part of the forearm, showing the effect of a gunshot wound made thirty years ago. The print shows how the ulna, some inches of which was shot away, has attached to the radius, and also shows some half a dozen shot still in the arm. It would have been difficult to get such clear shadowgraphs of objects so large as these without a diaphragm.

slightly; and the occasional small electrostatic spark from the surface of the tube to the hair, but which was hardly noticeable, will also not account for this effect. JOHN DANIEL.

PHYSICAL LABORATORY,
VANDERBILT UNIVERSITY, March 23, 1896.

INSTINCT.

TO THE EDITOR OF SCIENCE: Having read with considerable interest the discussions under *Instinct*, and having noticed the different opinions expressed concerning the eating and drinking of the chick, I thought that perhaps my personal experiments in regard to the matter might be of interest.

About eight years ago I was desirous of studying the chick before and after hatching, and for this purpose I placed about three hundred eggs in an incubator. I shall confine myself to those that were allowed to hatch.

Those that hatched were divided into two groups, an unhealthy and a healthy group. Those in the first group were fed and given water until they became strong enough to care for themselves. Those in the second group had food and water placed so that they could get them, but they were not fed nor given water, nor were they taught how to secure food and water. No tapping on the dish or on the floor, and no putting of the bill in the food or water was practiced. They were left entirely to themselves.

By watching these chicks, I noticed that they would occasionally run over their food and water, and frequently they stumbled in them. If the beak became wet, up would go the head, and the water was swallowed. If food adhered to the beak, some would get on the tongue, and it would be swallowed. In time they seemed to recognize that the food and water were palatable by repeatedly stumbling in them and getting them on the beak, and finally they *learned* how to secure them, *i. e.*, how to pick them up. I noticed that at first they did not know how to pick up, but, after repeatedly trying, they learned how. The majority of these chicks lived and developed.

Now if we consider the attempt to pick up, from observation I conclude that it was by *instinct*; but if we consider the picking up, I conclude that it was an *acquired* characteristic.

In conclusion, I might say that at the end of the third day all of the chicks—about fifty— instinctively attempted to pick up, and that at the end of the fifth day they were able to pick up and place the food or water so that it could be swallowed. J. C. HARTZELL, JR.

ORANGEBURG, S. C., March 25, 1896.

VISUALIZATION AND RETINAL IMAGE.

A STORY which has been going the rounds of the press about a successful attempt by Mr. Engles Rogers at photographing his own retinal image of a dead child, said image being produced by visualizing effort, induces me to suggest through SCIENCE that the subject is worthy of more thorough investigation than it has yet received. What effect also hallucination has upon the retina might be determined from study of insane patients dead from hallucinatory fright, etc. In some cases of sudden death by accident there seems to be evidence of a persistence of retinal image; and it seems highly desirable that hospital surgeons should have a simple instrument for investigating such cases. An image which should represent other scenes than the surroundings at time of death might be evidence for mere visualization effecting a retinal image. HIRAM M. STANLEY.

LAKE FOREST, ILL.

NAVAL EROSION.

TO THE EDITOR OF SCIENCE: An interesting locality for obtaining some measure of the interference of navigation with the normal geological cycle is the Kennebec River, in Maine. Several summers ago, chancing upon this river, I was struck with the completeness of the phenomena of erosion produced by our steamer in disturbing the water.

This stream is an estuary for nearly forty miles from its mouth. It has numerous islands and in many places steep banks. There is a vast amount of glacial material strewn along its shore which, with the matter brought down stream, has silted the river bottom completely. I noted all along the shore that the water in advance of the steamer rose slightly on the bank, but was immediately drawn back to fill the space just occupied by the boat. At some points this recession amounted to fifteen or twenty feet, and at no place was it less than